

Authorization No. 06-HPAC-PA3-000-000006

**AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH
HABITAT**

Authorization issued to:

Name: Regional District of Nanaimo
Address: 6300 Hammond Bay Road, Nanaimo, BC, V9T 6N2
Telephone (250) 390 - 6547
Fax No.: (250) 390 - 1542
Date: June 28, 2006

Location of Project:

The project site is situated on Walley Creek parallel to Hammond Bay Road between Shores Drive and McGuffie Road within the City of Nanaimo.

Valid Authorization Period:

This Authorization is valid for the period of July 1 to September 30, 2006.

Description of Works or Undertakings (Type of work, schedule, etc.):

The harmful alteration, disruption or destruction of fish habitat hereby authorized is the realignment of approximately 350 m of Walley Creek. The project includes construction of the new channel and planting of riparian vegetation. The authorization is for the channel relocation only and does not include any other disturbance within the riparian zone (that area between Walley Creek and Hammond Bay Road) except for the widening of the existing sidewalk adjacent to Hammond Bay Road to a 3 m width.

CONDITIONS OF AUTHORIZATION

A) Liability:

1. The Regional District of Nanaimo (RDN) confirms that all plans and specifications relating to this Authorization have been duly prepared and reviewed by the appropriate professionals working on their behalf. The RDN acknowledges that it is solely responsible for all design, safety and operational aspects of all the works associated with this Authorization.
2. Harmful alteration, disruption or destruction of fish habitat other than that specifically

identified within this Authorization is not permitted.

3. Works will be conducted following the practices outlined in the following reports:

- Associated Engineering Ltd. Design Drawings dated May 2006.
- Walley Creek Relocation Report – Associated Engineering Ltd. 2003.
- Walley Creek Channel Relocation – Impact Mitigation and Re-vegetation Plan V.1.0

B) Conditions that Relate to the Harmful Alteration:

1. No instream work or any construction activity within 5 m of Walley Creek shall occur outside the Fishery Work Window of July 1 to September 15, without the specific permission from Fisheries and Oceans Canada.
2. A sediment and drainage management plan shall be drawn up prior to the start of the project and updated as required during construction. The purpose of the plan will be to maintain the drainage of ground and surface water from the site during construction to ensure it does not migrate into Walley Creek where it can impact on fish and fish habitat.
3. To the extent possible, all instream works are to be undertaken in isolation of stream flows. This consists of ensuring that the worksite must be isolated and dewatered after having all fish salvaged and relocated to a suitable area upstream or downstream. All flow upstream of the work must be re-routed around the work site to allow for continuous flow downstream, free from any contaminants from the worksite.
4. Prior to diverting flows into the new channel, a thorough fish salvage of the old Walley Creek channel will require to be undertaken to ensure that there is no stranding or killing of fish within the old remnant channel.
5. Any machinery that must work within the wetted perimeter of Walley Creek must convert their hydraulic and lubrication oils to a non-petroleum based mineral hydraulic oil which is non-toxic and inherently biodegradable (Chevron Clarity product or equivalent). All operators working within the wetted perimeter of Walley Creek must show compliance with this requirement.
6. All temporary material, fill, bridge, culvert, pump, pipe, conduit, ditch or other structures used to assist in the construction of any works, are to be maintained only during the period of construction and are to be removed on completion of the works.
7. The work shall proceed in a manner that minimizes the release of sediment and ensures no disposal of any materials deleterious to fish. The work shall, therefore, not proceed during adverse weather conditions of high rainfall and streamflows and contractors shall ensure that all machinery and equipment is in good working condition and power washed so that no fuels, lubricants or construction wastes enter the stream.
8. A re-fuelling spill kit must be on site for the duration of operations and a person properly trained to use the spill kit must also be present. Re-fuelling must be done at an upland location, which will not permit the introduction of fuel into the watercourse. Any fuel or chemical spills into Walley Creek must be reported to the Provincial Emergency

Program (1-800-663-3456).

9. All disturbed areas are to be protected against erosion and re-contoured to provide long term stabilization. All disturbed areas within 15 m of Walley Creek are to be replanted with a combination of ground cover, shrubs and trees prior to October 30, 2006.
10. Prior to construction, a snow fence is to be erected to delineate the construction boundary. No vegetation removal is to occur beyond the snow fence.
11. To ensure compliance with acceptable environmental practices, the Regional District of Nanaimo will retain a qualified Environmental Monitor (the "Monitor") for the project. The Monitor shall have the authority to modify or suspend construction operations that violate safe environmental practices and procedures. The Monitor shall be directly involved in all mitigative works as outlined in the project documents and shall have the authority to halt or modify works if fish and fish habitat is at risk. The monitor should be on-site at all times during instream works and as deemed appropriate to ensure the protection of Walley Creek during the remaining periods of the project construction.
12. The Environmental Monitor shall be responsible for:
 - a. Planning and execution of fish salvage(s);
 - b. Planning and implementation of a sediment control plan;
 - c. Delivery of day to day monitoring of construction activities to ensure that all works are in compliance with the conditions outlined within the Authorization.
 - d. Preparation of a post construction monitoring report with dated color pictures of the site prior to, during and following completion of the works. The report should describe the works methodology, water quality and fish sampling results and provide a brief summary of the project, including problems that occurred and how they were resolved. The reports are to be submitted to Alain (Al) Magnan, Project Assessment Biologist, Fisheries and Oceans Canada, 3225 Stephenson Point Road, Nanaimo, BC, V9T 1K3 within 60 days after completion of the project.
13. The contractor shall arrange for a "pre-construction meeting" with the Monitor to discuss the proposed construction schedule and work procedures with specific reference to the conditions of the Authorization.
14. Notification at least 7 working days prior to the start of the work is required in writing. Notification should be submitted to the attention of Alain (Al) Magnan, Project Assessment Biologist, Fisheries and Oceans Canada, 3225 Stephenson Point Road, Nanaimo, BC, V9T 1K3.

C) Description of Compensatory Works:

The Walley Creek realignment project consists of decommissioning of 110 m of artificial channel, weir and culvert adjacent to the RDN treatment facility and realigning of an

additional 230 m of natural stream channel. In total approximately 13,501 m² of fish habitat (includes riparian vegetation) will be impacted due to the relocation of Walley Creek.

In order to determine adequate habitat compensation and for the project, a habitat balance sheet was developed which provides Equivalent Habitat Area (EHA) values for both pre and post development. The Equivalent Habitat Area method developed by Ian Whyte, Envirowest Environmental Consultants Ltd. 1995, involves identification of contiguous habitat type polygons along the stream channel and riparian corridor for both pre and post development condition, determination of the area of each polygon and assignment of a habitat class and relative habitat quality/productivity rating from a table or pre-defined values. Polygon area multiplied by habitat quality rating provides an Equivalent Habitat Area (EHA) value for each polygon. Summing the habitat polygon areas and EHA values provides a total area and EHA value for the pre and post development conditions.

Based on calculations undertaken for this project, realignment of Walley Creek will impact 13,501 m² of fish habitat, including riparian vegetation. Converting the value of this habitat using EHA values indicates that the Walley Creek realignment will result in a loss of 2924 m² EHA. Construction of the new channel will result in the creation of 4126 m² EHA, a net gain of 1202 EHA (a 41.13% increase in EHA).

The channel design is as described within the Associated Engineering Ltd. May 2006 design drawings.

The relocation of Walley Creek will occur within an approximately 30 to 40 m wide corridor bounded to the north by RDN Greater Nanaimo Water Pollution Control Centre (GNWPCC) treatment plant and to the south by Hammond Bay Road. As the new alignment of Walley Creek has been positioned to take advantage of existing riparian vegetation, topography and the need to provide some sinuosity to the channel, it is not located in a straight line within this corridor. Consequently, sections of the Walley Creek on the RDN property may have riparian widths from as low as 5 m from top of bank, with the opposite side having an increased width of 20 to 25 m from the top of bank. DFO and the RDN agree that the reduced leave strip on one side of the stream is compensated for by the increased leave strip on the other side of the stream. As part of this compensation, both parties agree to the following:

1. Future expansion of the GNWPCC can occur up to the fence directly north of the newly aligned Walley Creek as identified on the Walley Creek - Associated Engineering Design Drawings (May 2006). Despite the fence being within the 15 m riparian area of the newly aligned Walley Creek, DFO will not be requesting additional habitat compensation in the future when the construction works are undertaken at the GNWPCC.
2. The increased riparian width on the south side of the newly aligned Walley Creek is to be considered as compensation for the reduced riparian width on the north side. Consequently, there is to be no vegetation removal or development within the area between Walley Creek and Hammond Bay Road including those areas which may be more than 15 m from the top of bank of the new stream channel. This restriction is to include any proposed trail construction. DFO has no objections to the existing sidewalk adjacent to Hammond Bay Road being increased in width to 3 m to accommodate an all purpose trail system.

D) Timelines for Compensatory Habitat:

The habitat compensation works will be completed by October 31, 2006.

E) Conditions that Relate to the Compensatory Habitat:

1. Construction of all habitat compensation features must be undertaken under the direction of a qualified restoration biologist with experience in this field following the design concepts and plans. It is understood that site limitations and field conditions may require some variances from these design plans. Such variances are only to be undertaken by the on site restoration biologist overlooking construction of the habitat compensation works.
2. All conditions outlined in Section B of this Authorization "Conditions that Relate to the Harmful Alteration", including the requirement for an Environmental Monitor are to be adhered to during construction of the habitat compensation works.
3. For planted riparian vegetation, a minimum success rate of 80% of the planted stock is required. Any plant mortalities beyond 80% of the plants must be replanted on a yearly basis.

F) Monitoring Program:

1. The RDN shall carry out a five (5) year monitoring program (the "Monitoring Program"), which is to include the following:
 - a) An annual documented assessment of the compensatory habitat completed by a qualified biologist or other professional who has experience in this area and who is independent of DFO, the City of Nanaimo and the RDN. This report is to be submitted by the first of February for the previous calendar year of the Monitoring Program to the Nanaimo DFO office (Attn. Mr. Alain Magnan). The Monitoring Program will consist of a minimum of four yearly site visits during the following periods: 1) spring resident trout spawning period, 2) fall period, 3) winter high flow period and 4) summer low flow period and is to include:
 - I. A photographic assessment of the compensatory habitat showing pools, riffles, cedar log clusters, channel substrate and replanted vegetation, etc.
 - II. An assessment of the survival of the planted vegetation. A minimum plant survival of 80% is required. Additional planting is to be conducted should plant survival not achieve 80% success on a yearly basis.
 - III. An assessment of the structural stability of the works, identifying any failures and describing restoration measures taken to remediate failures.
 - IV. A determination of fish usage of the channel where the compensation habitat was installed including potential spawning use.

- b) A final report at the end of the five year period confirming that the habitat compensation works are biologically functioning and that a "No Net Loss" of fish habitat has been achieved.

G) Determination that Compensatory Habitat is Functioning as Intended:

The compensatory habitat will be deemed to be functioning as intended if, in the opinion of DFO, the stream channel is stable and is providing viable new fish habitat and that 80 % survival has been achieved on the revegetation works. Following the initial monitoring period and any extensions thereof, DFO will assess the habitat compensatory works and determine whether or not it is functioning as intended, and choose the appropriate course of action as outlined below:

- i) The habitat compensatory works are functioning as intended and will be self-sustaining without further remedial work. The Monitoring Program will be terminated; or
- ii) The habitat compensatory works are not functioning as intended. The RDN shall provide a plan and, once approved, undertake remedial works and extend the Monitoring Program for an additional two years to allow more time for the habitat to become adequately established; or
- iii) The habitat compensatory works are not functioning as intended and further remedial work is not likely to rectify the situation, resulting in a net loss of fish habitat. The RDN shall then carry out alternative compensatory works mutually agreed to by Fisheries and Oceans Canada and the RDN to ensure a no net loss of fish habitat is achieved.

If, at any time during the monitoring program DFO determines that either of the habitat compensatory works are functioning as intended and that further monitoring is no longer required, DFO may terminate the Monitoring Program by providing the RDN with a notice in writing.

H) Provision for the Amendment of Conditions under Authorization:

Subject to consultation with and agreement of Fisheries and Oceans Canada and following the intent of this Authorization, specifically the provisions outlined in Section G, amendments to the conditions of this Authorization may be established to provide flexibility in the development, maintenance and protection of the compensatory habitat consistent with ensuring that the natural productivity of the "affected habitat" is maintained.

I) Possibility of Failure of Compensatory Works:

The RDN shall ensure that the compensatory habitat is functioning as intended for a period of five years post creation of compensatory works pursuant to Sections E, F and G of this Authorization. If at any time during this period the RDN becomes aware that the compensatory habitat is not functioning as intended, the RDN shall carry out works and additional monitoring which are necessary, as determined by Fisheries and Oceans Canada, to ensure that the habitat compensatory works are functioning as designed.

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J) Remedial Works:

In the event that the compensatory habitat is not functioning as intended as determined by Fisheries and Oceans Canada from on-site inspection(s) and/or information provided by the RDN, RDN shall carry out whatever remedial works and associated monitoring are necessary to enable the compensatory habitat (works) to function as intended pursuant to Sections E, F and G in this Authorization.

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Authorization:

The holder of this Authorization is hereby authorized under the authority of Section 35(2) of the *Fisheries Act*, R.S.C., 1985, c.F.14, to carry out the work or undertaking described herein.

This Authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this Authorization may result in charges under the *Fisheries Act*.

A copy of this Authorization should be kept on site and work crews should be made familiar with the conditions thereto.

The RDN acknowledges that Fisheries and Oceans Canada has consulted with it regarding the terms of this Authorization, and confirms that it has reviewed and understands the terms of this Authorization, and agrees to the terms contained therein.

Date of issuance: July 6, 2006

Approved by: Mr. Rob Russell
Mr. Rob Russell

Title: Senior Habitat Biologist
Oceans, Habitat and Enhancement Branch
South Coast Area
Fisheries & Oceans Canada

Executed by an authorized signatory of the Regional District of Nanaimo on the 5th day of
June, 2006, in the presence of:

July

<u>L. Burgoyne</u>)	Per: <u>M. Pearce</u>)
Witness (signature))	Authorized signatory)
<u>Linda Burgoyne</u>)	<u>MARILEE PEARCE</u>)
(print name))	Name)
<u>Secretary</u>)	<u>Mgr. Adm. Services</u>)
Position within (Proponent Company))	Title)

**REGIONAL DISTRICT OF NANAIMO
NANAIMO, B.C.**

ISSUED FOR CONSTRUCTION

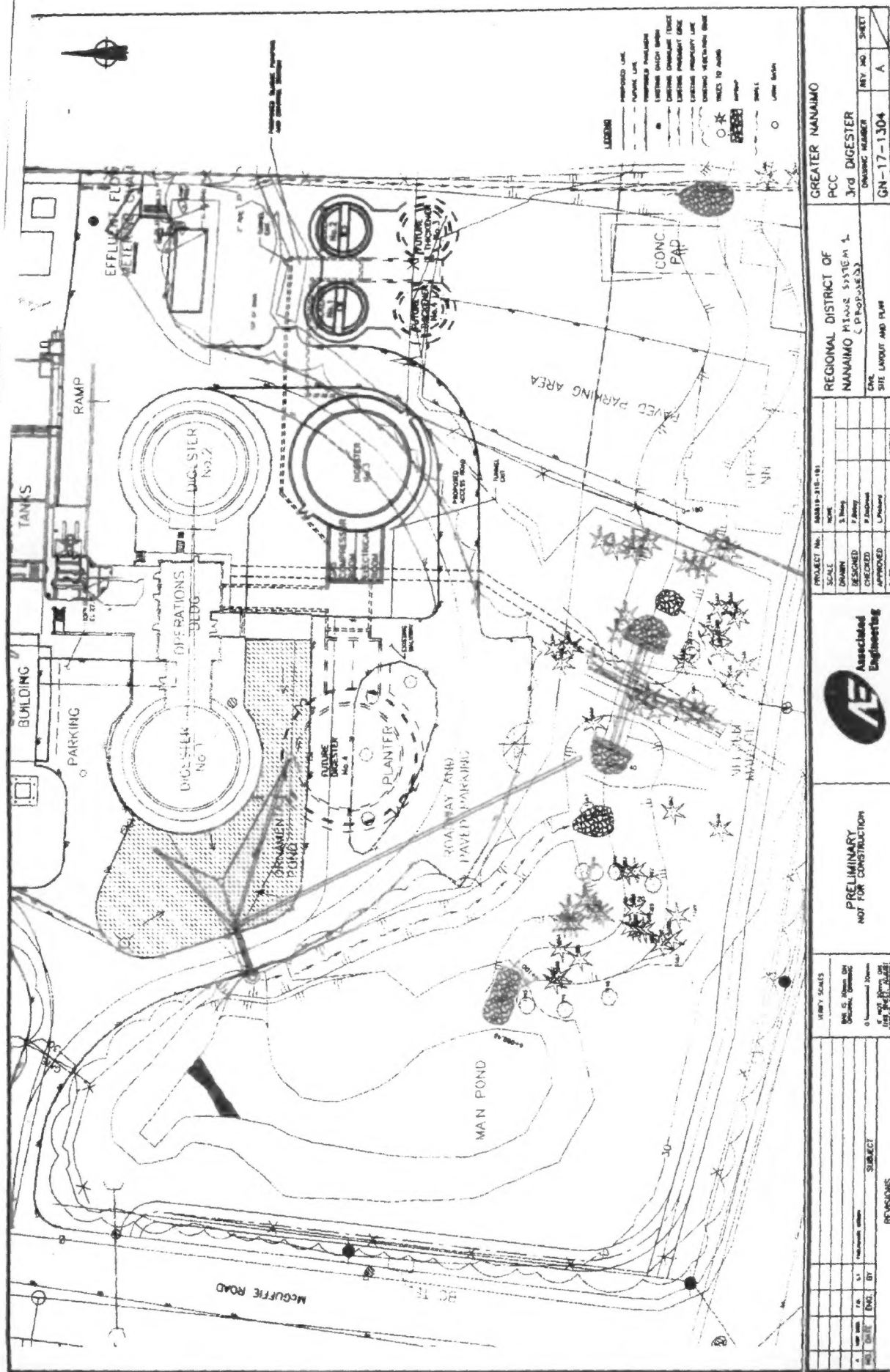
**GREATER NANAIMO PCC
WALLEY CREEK DAYLIGHTING**

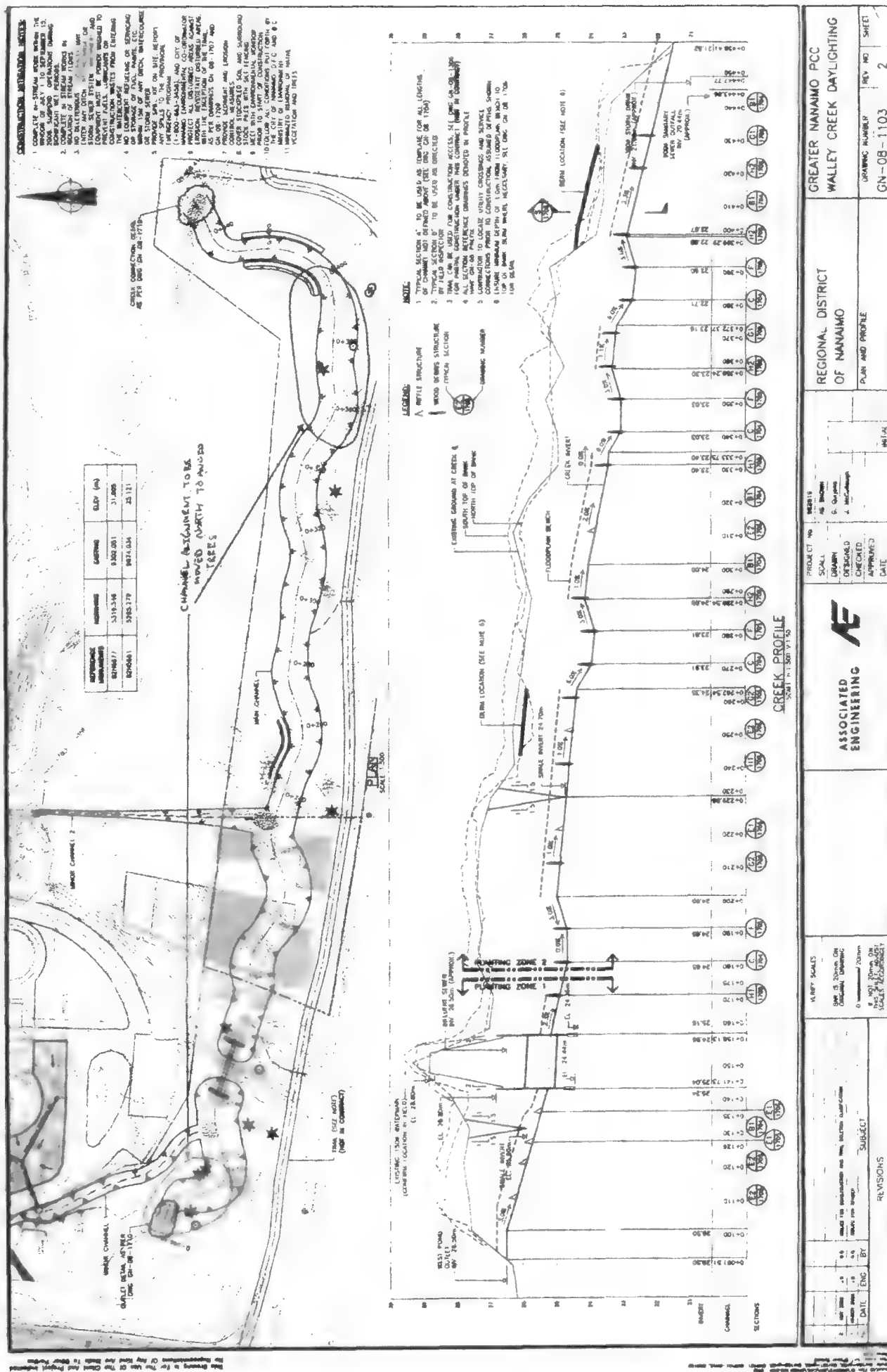
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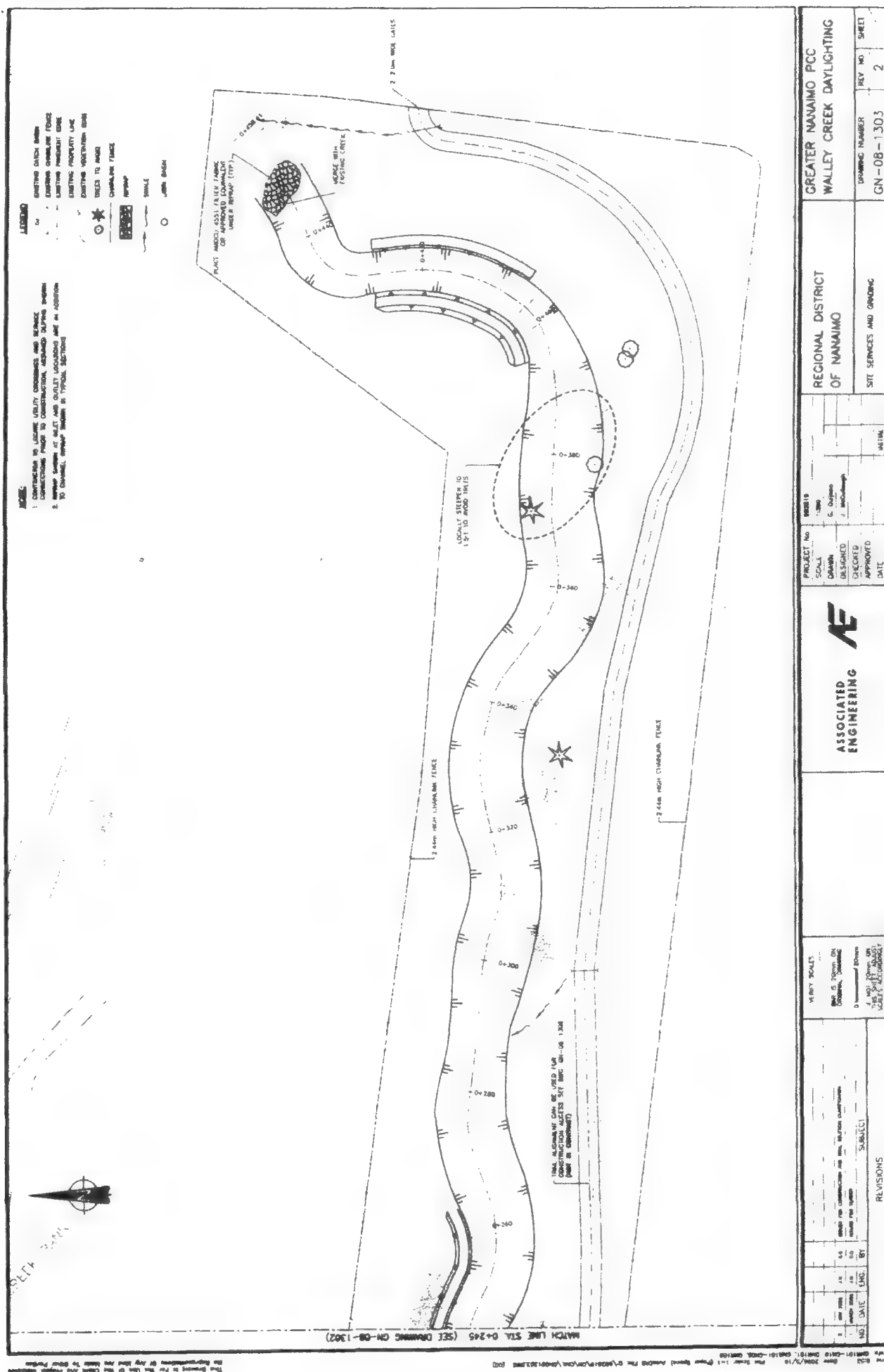
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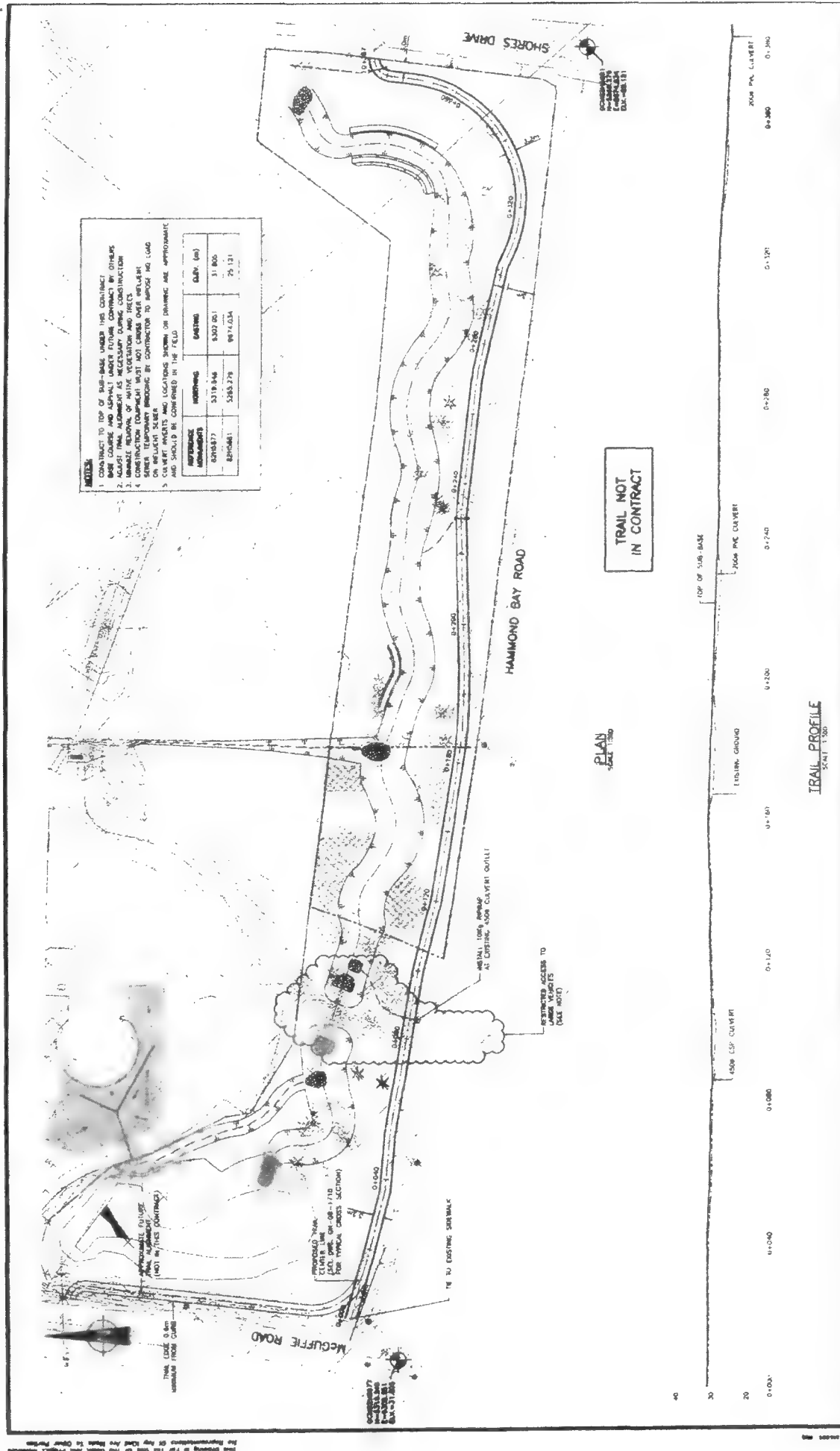
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01-00-15	DETAILS
01-00-16	ON SITE DISPOSAL AND TEMPORARY STORAGE
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01-00-18	HAZARDOUS AND SEWAGE
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01-00-20	HAZARDOUS AND SEWAGE



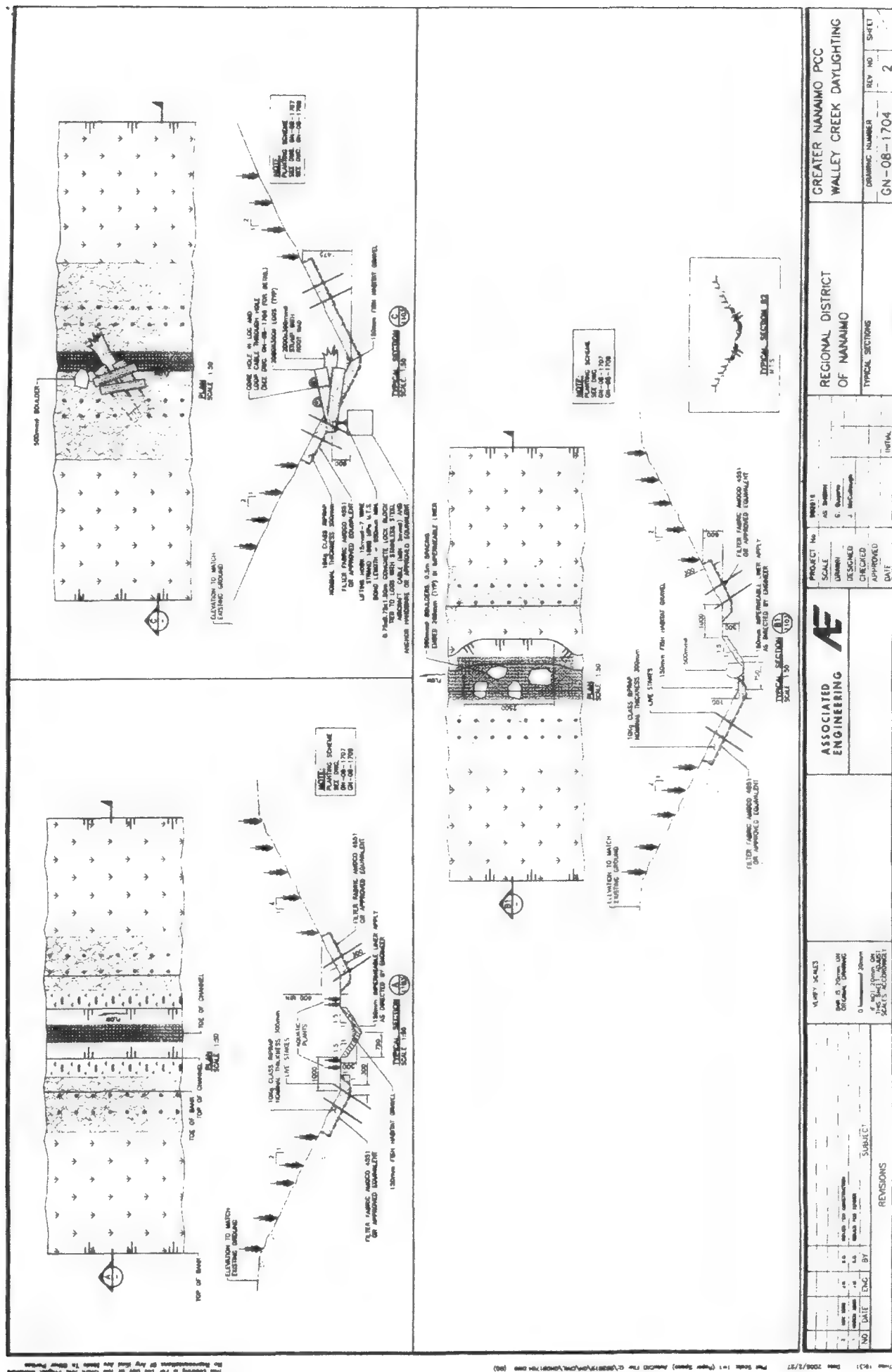


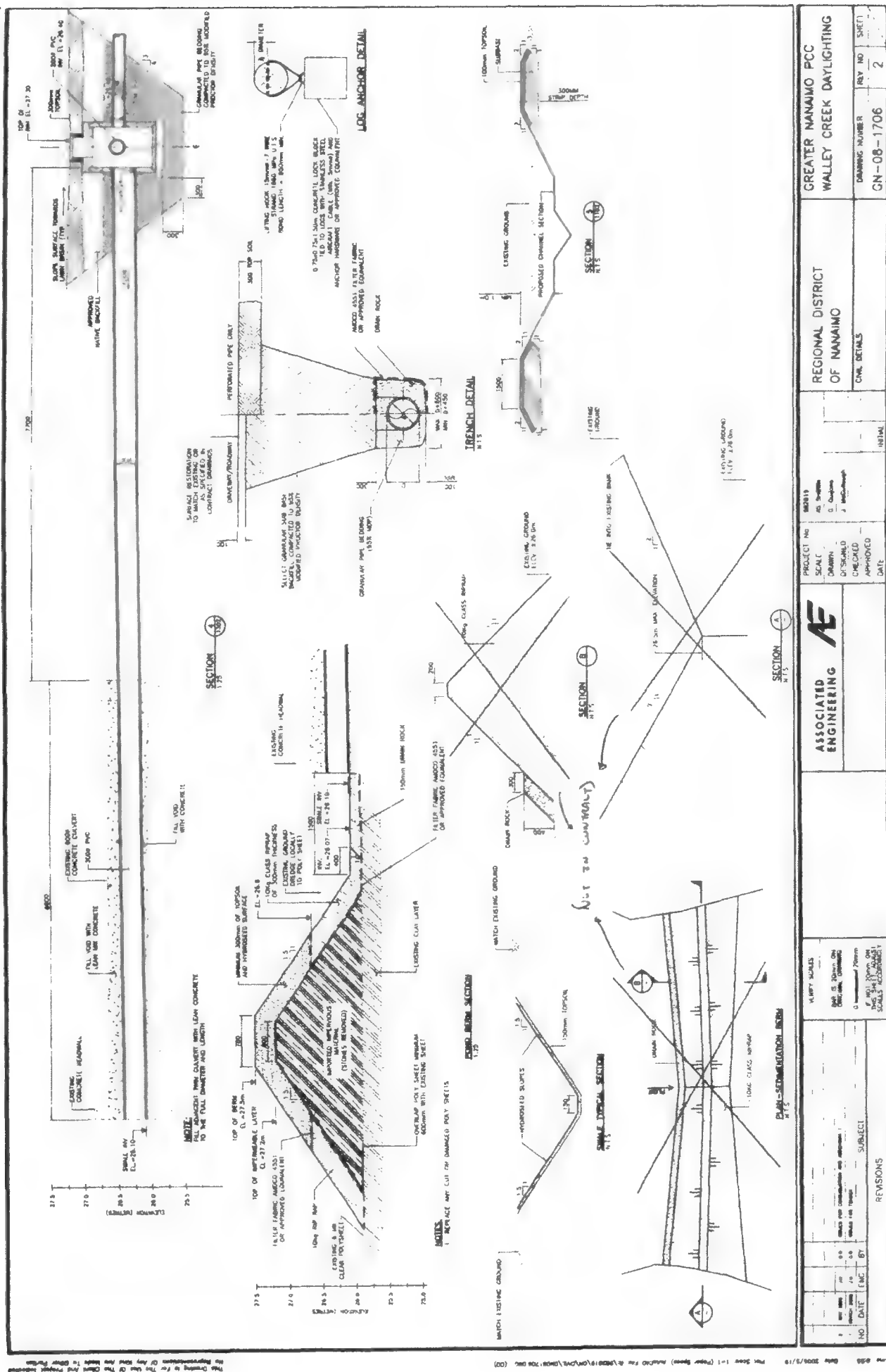




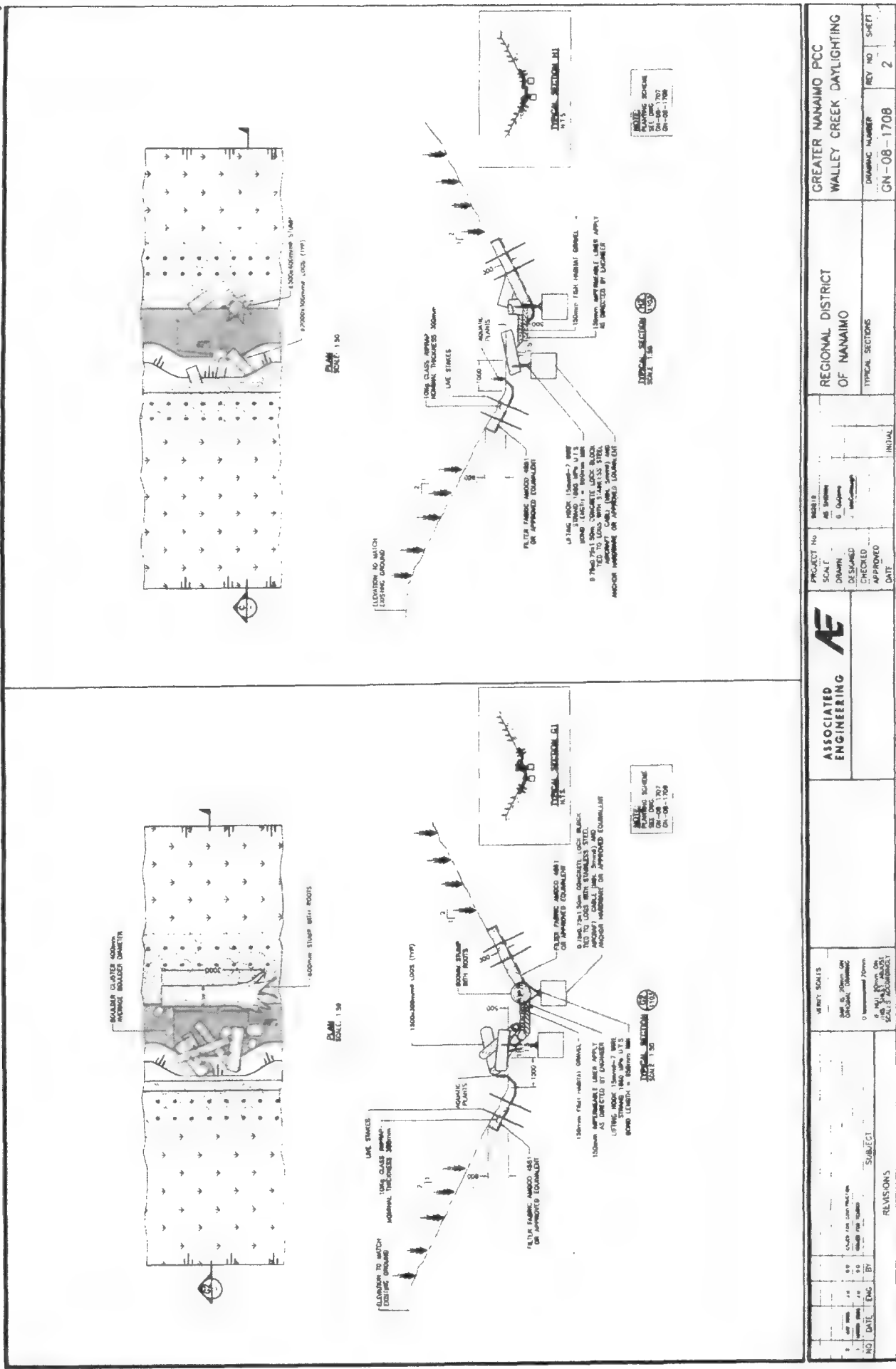


PROJECT NO. 480115		REGIONAL DISTRICT OF NANAIMO		GREATER NANAIMO PCC	
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DRAWN: C. O'Brien		CHECKED: J. Macdonald		DRAWING NUMBER: CN-08-1306	
DATE: 10/10/08		DATE: 10/10/08		REV. NO. 2	
APPROVED: [Signature]		DATE: 10/10/08		SHEET: 2	
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REVISIONS		NO. DATE		BY	
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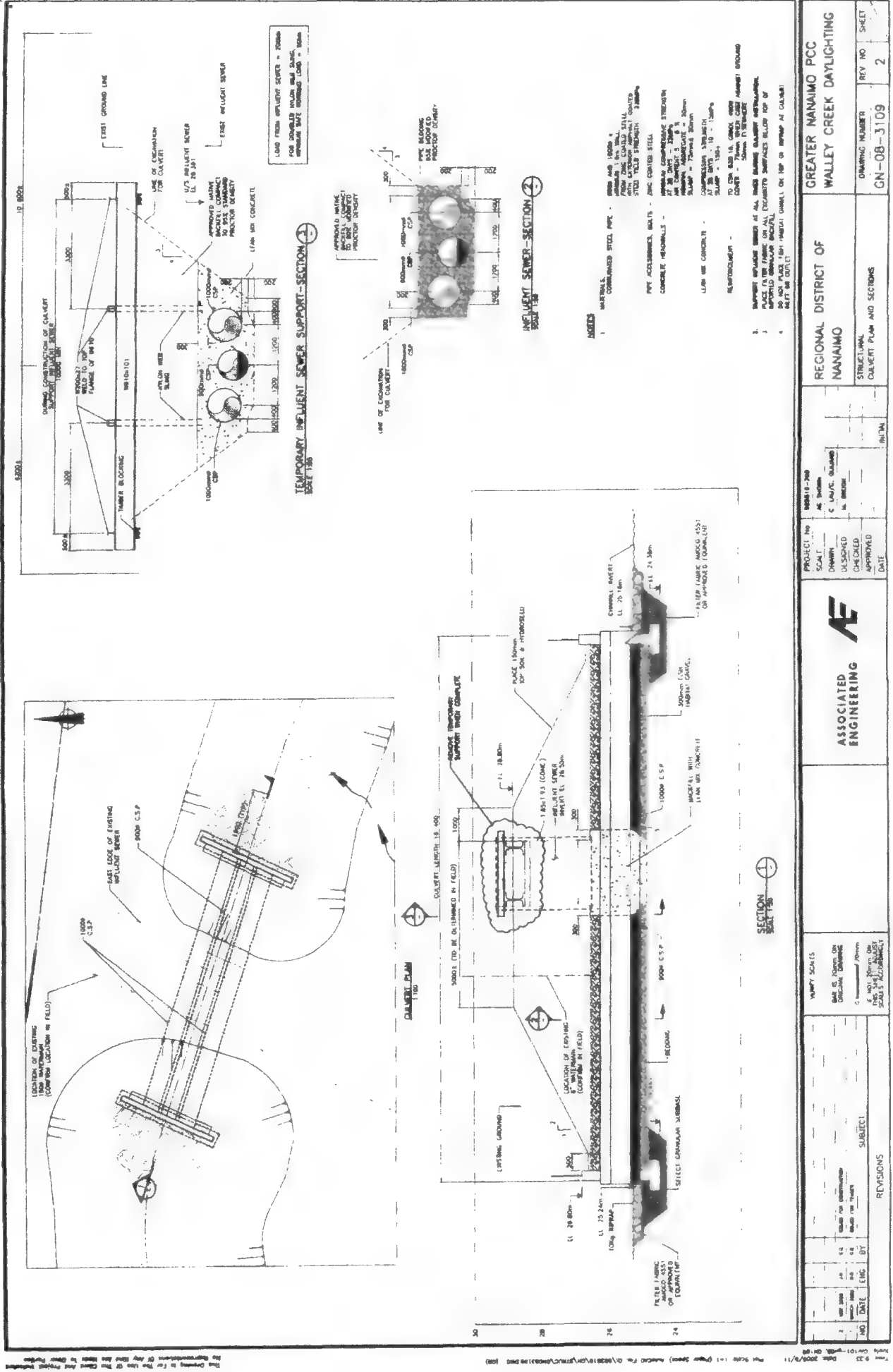
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WIDE LINE STAKES ARE 10 m LONG, 15 - 20 cm DIAMETER, BURY 3/4 LENGTH IN SOIL SURF FACE OF PAVEMENT. TIE/STAKE AS PER DETAIL ON SHEET. CM-08-1709

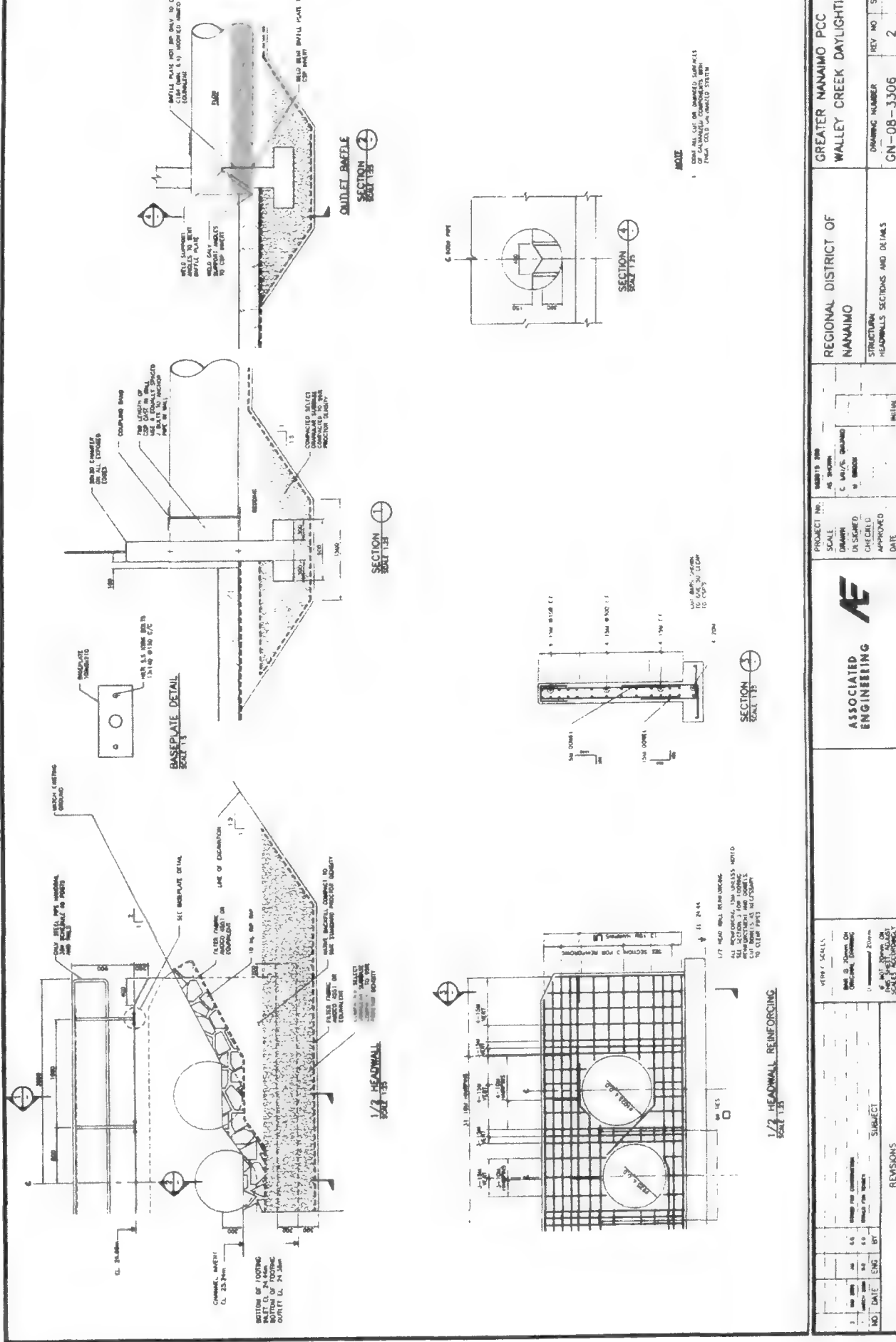
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WATERSHED Code:		WATERSHED:	Walley Creek
REGION:	East Coast Vancouver Island	LOCATION:	Regional District of Nanaimo

RIPARIAN SITE DESCRIPTION								
LAND TENURE:		Owner	Parcel (Lot) Identification:					
Government		Regional District of Nanaimo						
Coordinates								
WATERCOURSE:		Walley Creek			PLANTING UNIT:			
Polygon	Begins at:		Ends at:		Segment width:	Elevation:	Segment Length:	Plantable Area
1	0 m		40 m		5 m	80 m	40 m	~ 200 m ²
Notes:	This prescription provides for suitable and reasonable restoration of riparian natives to be planted within a recently disturbed segment of the streamside protection and enhancement (SPEA), which was established under the authority of Fisheries and Oceans Canada Fisheries Act Authorization # 06-HPAC-PA3-000-000006 on June 28, 2006. Additional live stake planting is recommended along the banks of Walley Creek where any other disturbance has occurred to establish a living root mat expected to reduce shear stress and reinforce substrate.							
Total Length and Area of plantable ground under this prescription							~40 m	~200 m ²

ECOLOGY		BioGeoClimatic Classification					
ZONE:	SUBZONE & VARIANT:	SITE SERIES:			EDAPHIC REGIME:		
CWH	xm1	05			4-5 / C-D – fresh to moist / rich		
Coastal Western Hemlock	Very dry maritime -eastern	Western Red Cedar-Sword fern					
SOIL TEXTURE:	LFH LAYER(S):	SOIL DEPTH:	Coarse Fragments:	ASPECT:	SLOPE:	ELEVATION:	Stream Class:
SL – Sandy Loam	0 - 5 cm	30 - 40 cm	15 - 35 %	SW	1-2%	65 - 80 m	S2
Comments:	An estimated 1.5 yards of native plant wood chips should be used to mulch the entire disturbed site.						

RATIONALE:
<ul style="list-style-type: none"> Riparian restoration within the SPEA is expected to restore features, functions and conditions that are vital to the natural maintenance of stream health and productivity. To provide erosion protection and augment bank stability some additional soil bioengineering methods (live stake) have been incorporated into the prescription. Bioengineering installations along channel banks prone to erosion are expected to provide structural integrity as the willow stems take root and grow, adding significant resistance to sliding or shear displacement.

PLANTING PRESCRIPTION:		
OBJECTIVES:	Enhance the riparian assemblage within a disturbed section of Walley Creek by planting a selection of native plant species suited to the site's ecology.	
PLANTING DIFFICULTY RATING:	Easy – Moderate	No obstacles to planting are anticipated.
SITE PREPARATION METHOD:	Manual excavating and finishing	<ul style="list-style-type: none">• Work with existing soil profile and excavate planting holes manually.• Remove invasive species manually and dispose off site.• Where required, provide minimum of 40 cm of topsoil for planting areas.
NET AREA TO BE PLANTED:	~ 200 m ²	Planting area includes an estimated 40 m long cut and fill area where a waterline was installed within a riparian restoration zone of Walley Creek. Final area may vary.
PLANT SPECIES & QUANTITY:	Refer to attached list (page 2)	
PLANT SOURCES:	Local nurseries specializing in native plant species. Wildlings may be used if dormancy has been achieved for deciduous species. Transplanting should be done carefully to ensure minimum disturbance to the plant's root system.	
TYPE OF STOCK	Container or bareroot as available. Largest stock available is recommended.	
AGE CLASS	one or two year old stock as availability dictates.	
SPACING:	variable - see plant list and comments	
PLANTING HOLE	SIZE: 1.5 times the diameter of the root ball	Remove existing non-natives as required.
	DEPTH: 1.5 times the depth of the root ball	
PLANTING MEDIUM:	Ensure stock is planted in an adequate depth (40-60 cm) of suitable substrate free of invasive species.	
PLANTING SOIL:	No fertilizer required at time of planting (see special clauses).	
SHADING:	n/a	Adequate overstory dominated by Coastal Douglas Fir. No supplemental shading required.
EXPECTED SURVIVAL:	85%	Biggest threats to survival will be desiccation during summer months and browse by ungulates and beaver. Previous riparian restoration work has a history of browse.

RECOMMENDED PLANT LIST:

SEG	COMMON NAME	SCIENTIFIC NAME	Minimum Quantity	Minimum Spacing	Comments
	TREES				
	Douglas-fir	<i>Pseudotsuga menziesii</i>	3	6.0 m	Excavate planting hole 1.5 times the dia and depth of root ball. Bonemeal and peat moss may be added to backfill native soil in each planting hole to increase organic matter content and enhance retention of water and nutrients.
	Western red cedar	<i>Thuja plicata</i>	3	6.0 m	Clustering groups of ≥ 3 specimens is acceptable for all tree species with minimum spacing of 6 m to be respected.
A-C	Douglas maple	<i>Acer glabrum</i>	3	6.0 m	As above
A-C	Pacific crab apple	<i>Malus fusca</i>	3	6.0 m	As above
A-C	Black twinberry	<i>Lonicera involucrata</i>	3	6.0 m	As above
A-C	SHRUBS				
A-C	Nootka Rose	<i>Rosa nutkana</i>	4	2.0 m	Adjacent to edge
A-C	Red Flowering Currant	<i>Ribes sanguineum</i>	2	2.0 m	Adjacent to edge
A-C	Salal	<i>Gaultheria shallon</i>	6	2.0 m	Adjacent to edge
A-C	Salmonberry	<i>Rubus spectabilis</i>	3	2.0 m	Along channel banks (as needed)
A-C	Thimbleberry	<i>Rubus parviflorus</i>	4	2.0 m	Along cut and fill
A-C	Snowberry	<i>Symphoricarpus albus</i>	6	2.0 m	Along cut and fill
A-C	Oceanspray	<i>Holodiscus discolor</i>	6	2.0 m	Along cut and fill
A-C	Red Osier Dogwood	<i>Cornus stolonifera</i>	6	2.0 m	Live stake along channel banks (as needed)
A-C	Scouler's Willow	<i>Salix scouleriana</i>	6	2.0 m	Live stake along channel banks (as needed)
A-C	Pacific Willow	<i>Salix lucida</i>	6	2.0 m	Live stake along channel banks (as needed)
A-C	Stink currant	<i>Ribes bracteosum</i>	3	2.0 m	Lower slope (as needed)
A-C	GROUND COVER				
A-C	Foxglove	<i>Digitalis purpurea</i>	4	Fill plant	Along cut and fill
A-C	Sword fern	<i>Polystichum munitum</i>	6	Fill plant	Along cut and fill
A-C	Dull Oregon-grape	<i>Mahonia nervosa</i>	6	Fill plant	Along cut and fill
	TOTAL PLANTS		83		

Notes:
<ol style="list-style-type: none"> 1. A duff layer will be limited across the planting site so plant with the root collar slightly below the mineral soil surface to prevent wicking of moisture from the root system. The top of the plug or root mass of container stock or the topsoil covering the roots of bare-root stock should be covered by a 1 - 2" layer of duff/organic mulch – see mulching clause below. 2. <u>Mulching</u>: Mulching of the planting site is recommended to reduce competition from non-native species and water loss. Mulching lower planting sites along the watercourse is not required as seepage flow is expected to maintain soil moisture. 3. <u>Release</u> suppressed conifer trees in all Polygons by competition removal and/pr spot fertilizing (see fertilizing clause). 4. <u>Thin</u> existing alder trees in all Polygons. 5. <u>Discourage</u> further encroachment of the SPEA. 6. <u>Fertilization</u>: Spot fertilize only as required to aid establishment of riparian plants. Broadcast fertilization methods is discouraged to avoid water quality impacts due to COD 7. <u>Quality assurance</u>: Standard horticultural/landscape BMPs are to be followed with regard to pre-plant stock care, storage & handling as well as planting quality, etc. Substitutions, additions or deletions to the plant list require approval from the prescribing biologist. 8. <u>Irrigation</u>: Irrigation treatment is recommended for at least 2-years (or until plant roots establish sufficiently) during dryer summer months. 9. <u>Weeding</u>: Removal of invasive species is recommended for at least 2-years (or until native plants establish sufficiently) with an aggressive effort during late spring and during summer months as required. 10. <u>Maintenance</u>: Seasonal and annual brushing, pruning, thinning, fertilization, weeding, irrigation and replacements should be incorporated into maintenance procedures. 11. <u>Soil bioengineering</u>: Live stake installation is prescribed to stabilize banks and help prevent soil erosion in areas of anticipated water saturation. Refer to attachment for specifications. Live willow stakes (70 cm long x 4-6 cm dia) can be used along channel banks. Plant deeply with 2 to 3 buds exposed only at top of cuttings. 12. <u>Artificial snags</u>: Opportunity exists to restore habitat for cavity nesting passerines by installing 1 or 2 vertically embedded snag features. Snags must have minimum dimensions of 15 m tall x 300 mm dia. This measure to enhance wildlife habitat is not a requirement. 13. <u>Fencing</u>: Existing fencing to protect establish plants from casual pedestrian traffic, ungulate browse and vandalism is in place and should be maintained for now.

PROJECT PLANNING DETAILS				
SEASON AND YEAR:	FALL 2011			
PRIORITY AND REASON:	HIGH - Site restoration following disturbance from utility installation			
ACCESS:	Adjacent to Sewage Treatment Plant			
DISTANCE AND DIRECTION				
OTHER CONSIDERATIONS	If weather and soil conditions are dry at the time of planting, an initial watering of the planting stock is required. As long as dry conditions persist after planting, additional irrigation may be required until the end of dry soil conditions.			
APPROXIMATE START-UP:	<input checked="" type="checkbox"/> EARLY	<input checked="" type="checkbox"/> MID	<input type="checkbox"/> LATE	Month: October
QUESTIONS:	Contact Person: Rupert Wong, R.P.Bio. (250) 338-8132			
ATTACHMENTS:	<ul style="list-style-type: none"> ○ Requires soil moisture or regular precipitation during the growing season to grow. ○ Enhances conditions for natural colonization of vegetation from the surrounding plant community. 			
SPECIFICATIONS FOR LIVE STAKE INSTALLATION – 2 PAGES				

Live Stake

Live stakes create a living root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting excess soil moisture. Most willow species root rapidly and begin to dry out an excessively wet bank once root systems have established. Live rootable vegetative cuttings are inserted or tamped into the ground. If correctly prepared, handled and placed the live stake will root and grow.

Applications and Effectiveness

Applications

- Use stakes in the wetted zone of banks where soil is prone to saturation (Figure 6).

Effectiveness

- Provides a technique where site conditions are uncomplicated, construction time is limited, and a cost effective method is required.
- Protects slopes from shallow slides (30 -60 cm/1- to 2-ft. depth).

Construction Guidelines

Live materials

- Stakes are generally 1" – 2" in diameter and 2' – 3' long. Specific site requirements and available cutting source will determine size.

Live material sizes and preparation

- Harvest during typical dormant season
- Remove side branches leaving bark intact.
- Cut the basal end at an angle for easy insertion into the substrate. Cut tops square.
- Install material the same day they are prepared or temporarily store submerged in cool fresh water.

Installation

- Orient buds up
- Install live stakes 2' – 3' apart using triangular spacing. Density of spacing will vary from 2 – 4 stakes per square yard. Site variations may require different spacing (i.e. allowing for water level variations). Start installation at any point on the slope face.
- Install 4/5 of the stake length into the ground and firmly pack soil around the stake after installation.
- Remove and replace any stakes that split during installation
- Use a dibbler or iron bar to make a pilot hole in firm soil.
- Wherever possible dig in live stakes unless the soil is fine and loose. Tamped in stakes may become compromised due to splitting or bark damage.
- Plant on banks that will be moist during growing season or install longer stakes that will reach the dry season water level.

LIVE STAKES
(Not to scale)

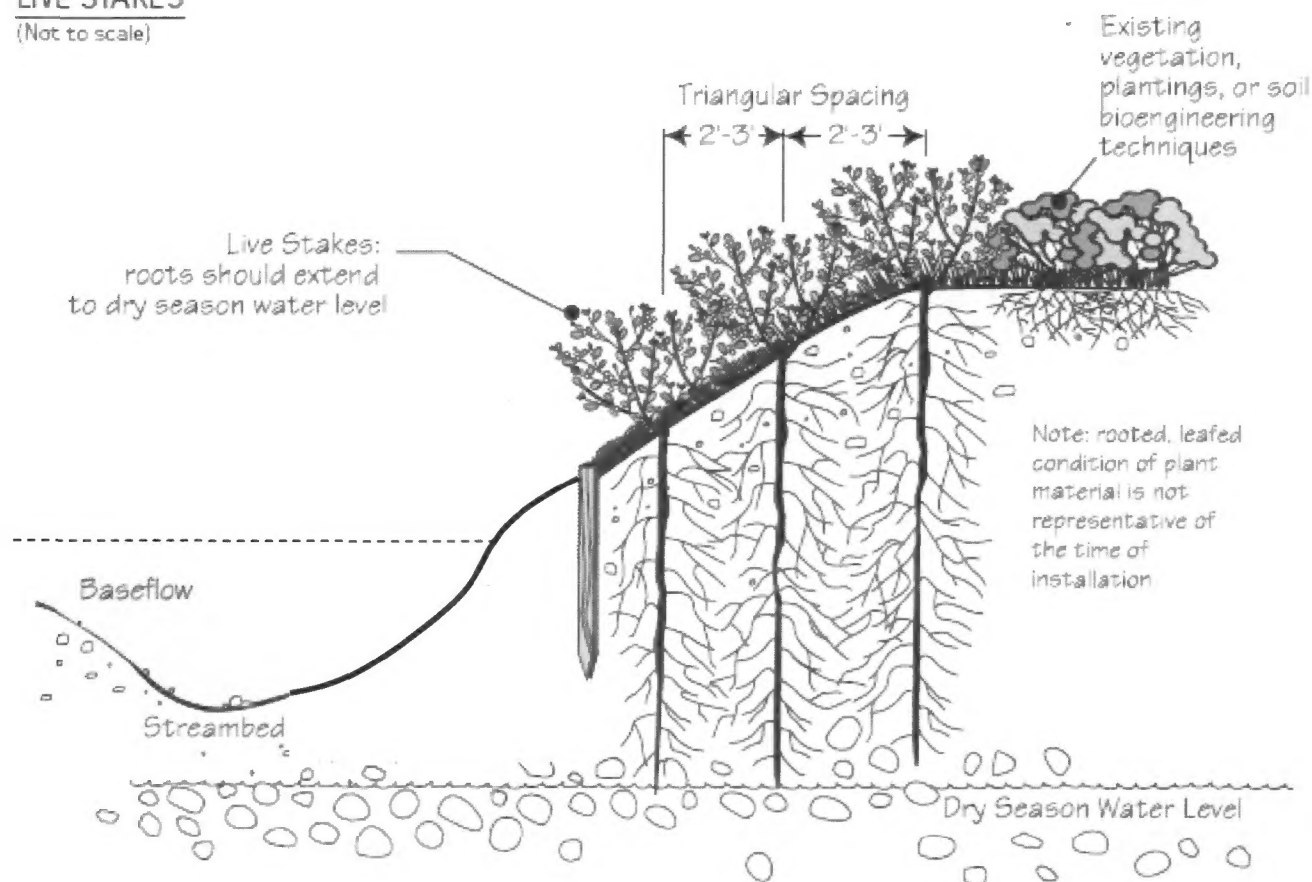


Figure 1. Typical live stake installation at water edge and toe of slope showing insertion to anticipated dry season water level (adapted from <http://www.fs.fed.us/publications/soil-bio-guide/guide/chapter5.pdf>)

